2019 PMM Science Team Meeting, November 4~8, 2019, Indianapolis, IN

Current status of GPM Ground Validation over Korea

November 7, 2019

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NMSC/KMA

NMSC

Outline

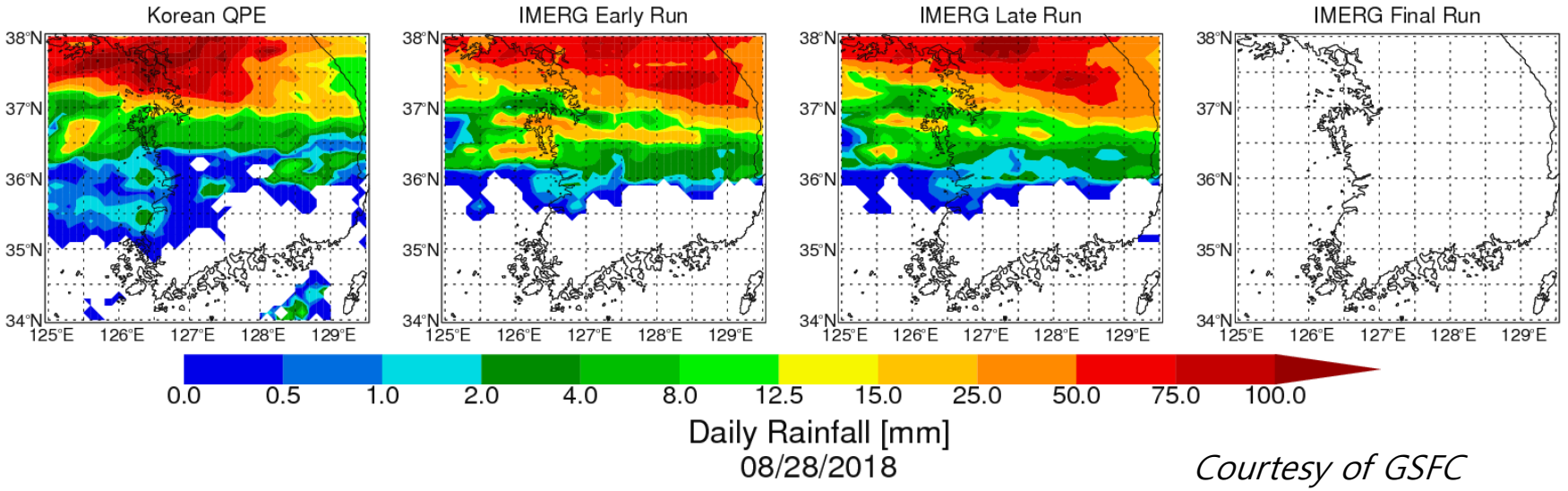
1 **New Ground Radar estimated Precipitation product**
Hybrid Surface Rainfall(HSR)

2 **Direct Validation**
2018-2019 result

3 **ICE-POP 2018**
Snowfall rate validation
Ocean flux

PMM history in Korea

- KMA/NASA GPM/PMM joint research (no-cost proposal)
  - "Algorithm Development, Calibration/Validation, Scientific Research"
  - Approved August 2009
  - Collaborating efforts to contribute GPM ground validation
    - Providing Real-time adjusted Radar-AWS rainrate (RAR) data for 11 KMA radar sites
    - Korean QPE data 1 x 1 km, 1-hour resolution
    - Comparisons between IMERG(V05) and Korean QPE since Mar 2014 (https://gpm-gv.gsfc.nasa.gov)
  - Publishing the GPM ground validation report using KMA observation network
    - Twice a year: Whole year and Summer (Snowfall report using GPROF)

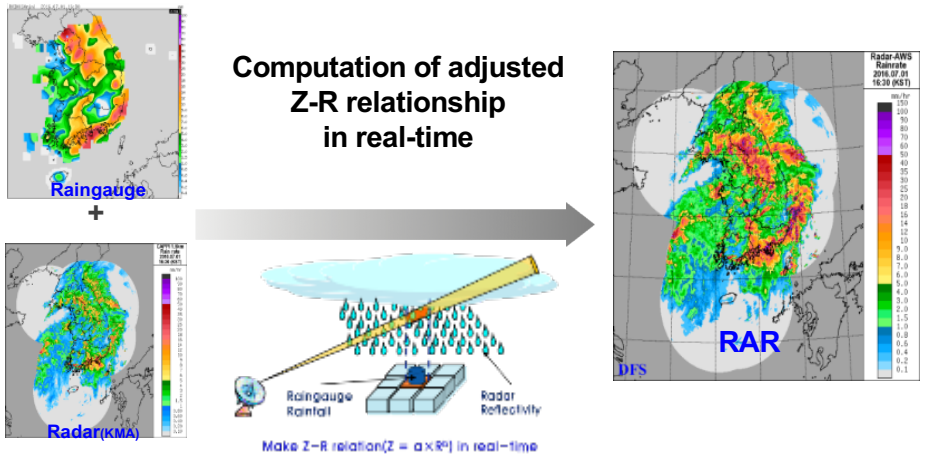


Courtesy of GSFC

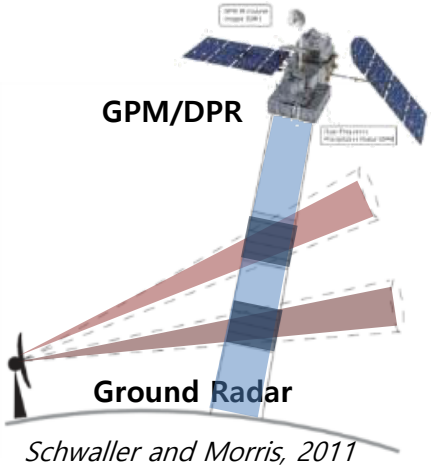
Updates since last meeting

Ground validation over Korea

RAR in KMA



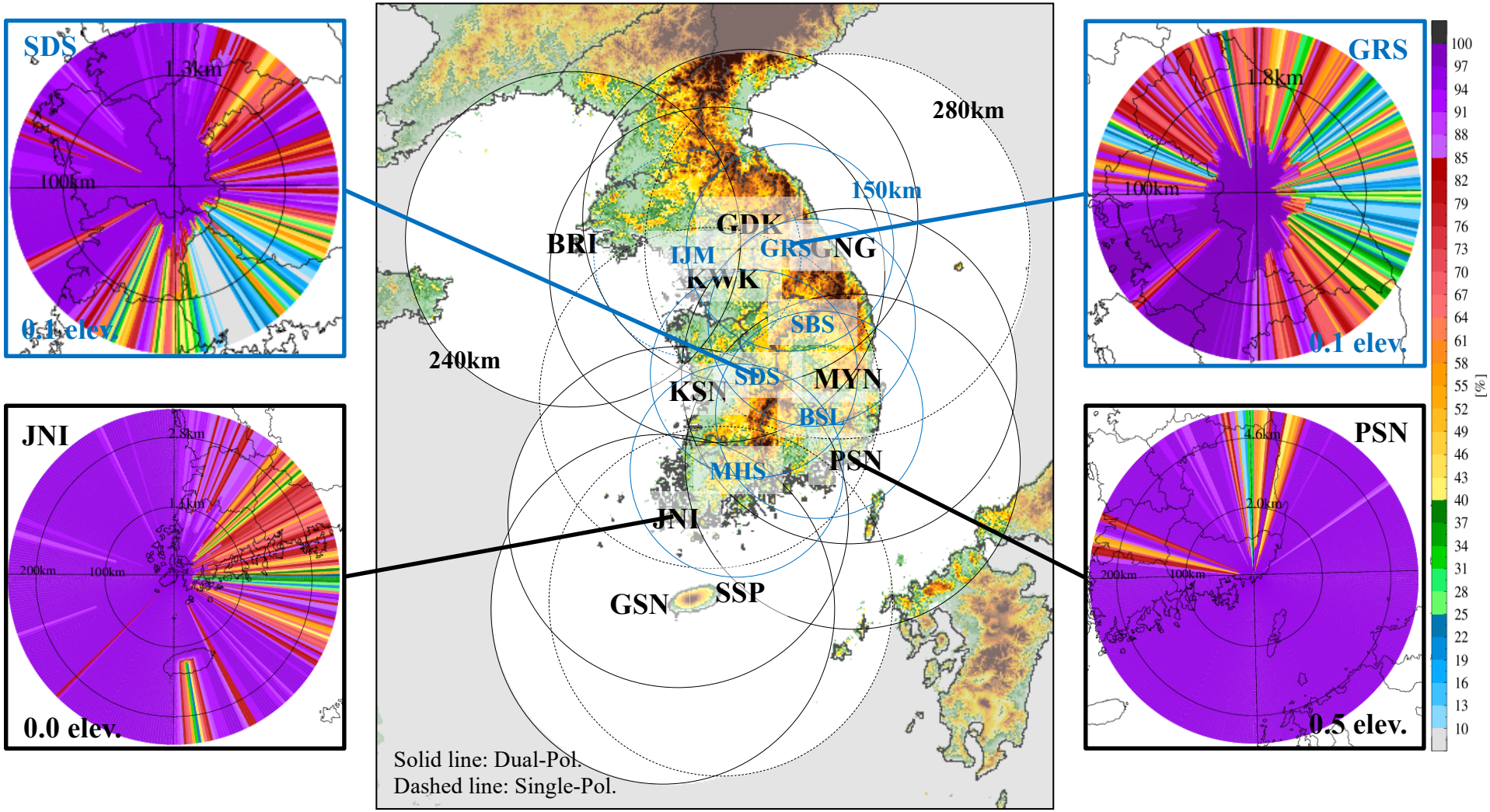
	Radar	AWS	RAR
Obs Range	11 radars (All sites : S-band)	642 points in Korea Peninsula	Composition of 11 KMA radars
Spatial Resolution	1km*1km (240km range)	about 13 km	1241*1761(1 km)
Time Resolution	10 min	1 min	10 min
Unit	dBZ	mm/hr	mm/hr



Schwaller and Morris, 2011

Problems

70% of Korean territory is covered with mountains and it causes severe radar beam blocking. Beam blockage leads to considerable under-estimation, even worse observation gap in QPE.



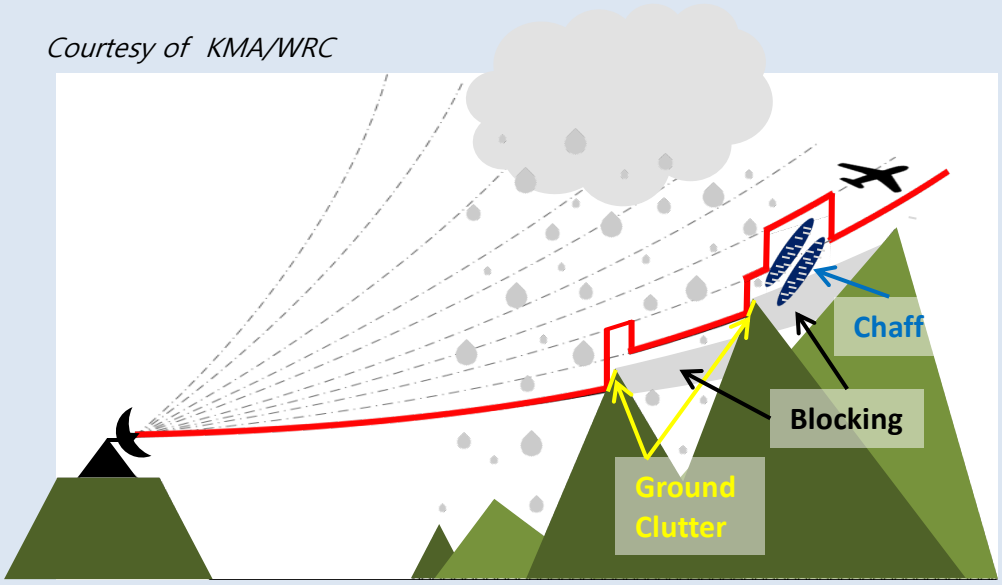
< Topography of the Korea peninsula and the observational area of the operational radar network of **KMA(black)** and **MOLIT(blue)** >

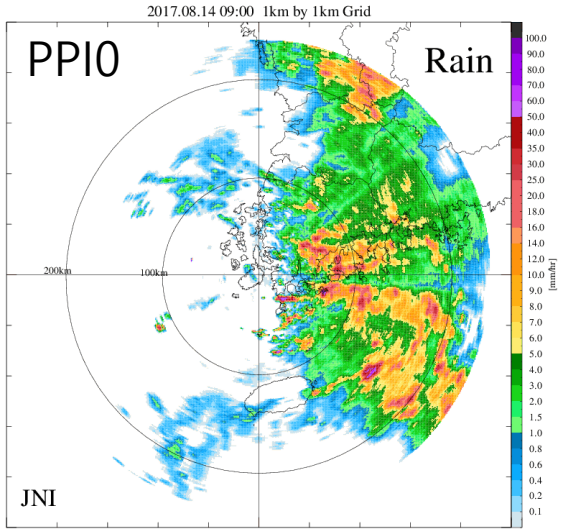
Hybrid Surface Rainfall (HSR)

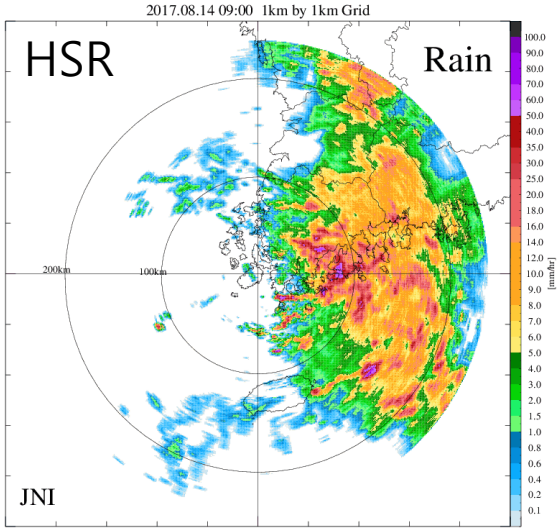
Rainfall Estimation Technique based on Hybrid Surface

: the rainfall estimation technique base on the *lowest-observable elevation surface*, in radar volume scan that is immune to radar partial beam blockage, ground clutter contamination, attenuation in rain and non-meteorological echoes

Courtesy of KMA/WRC

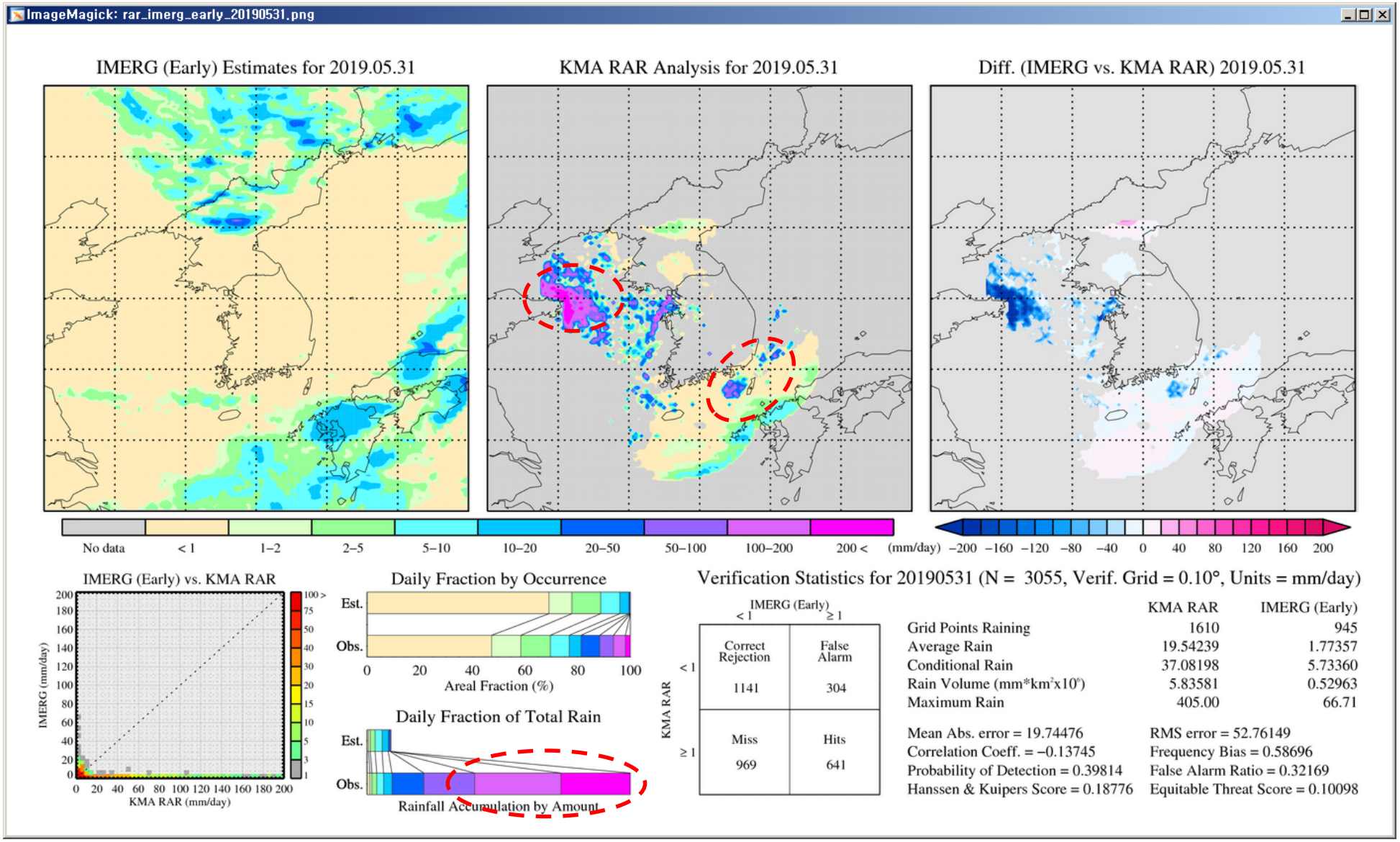




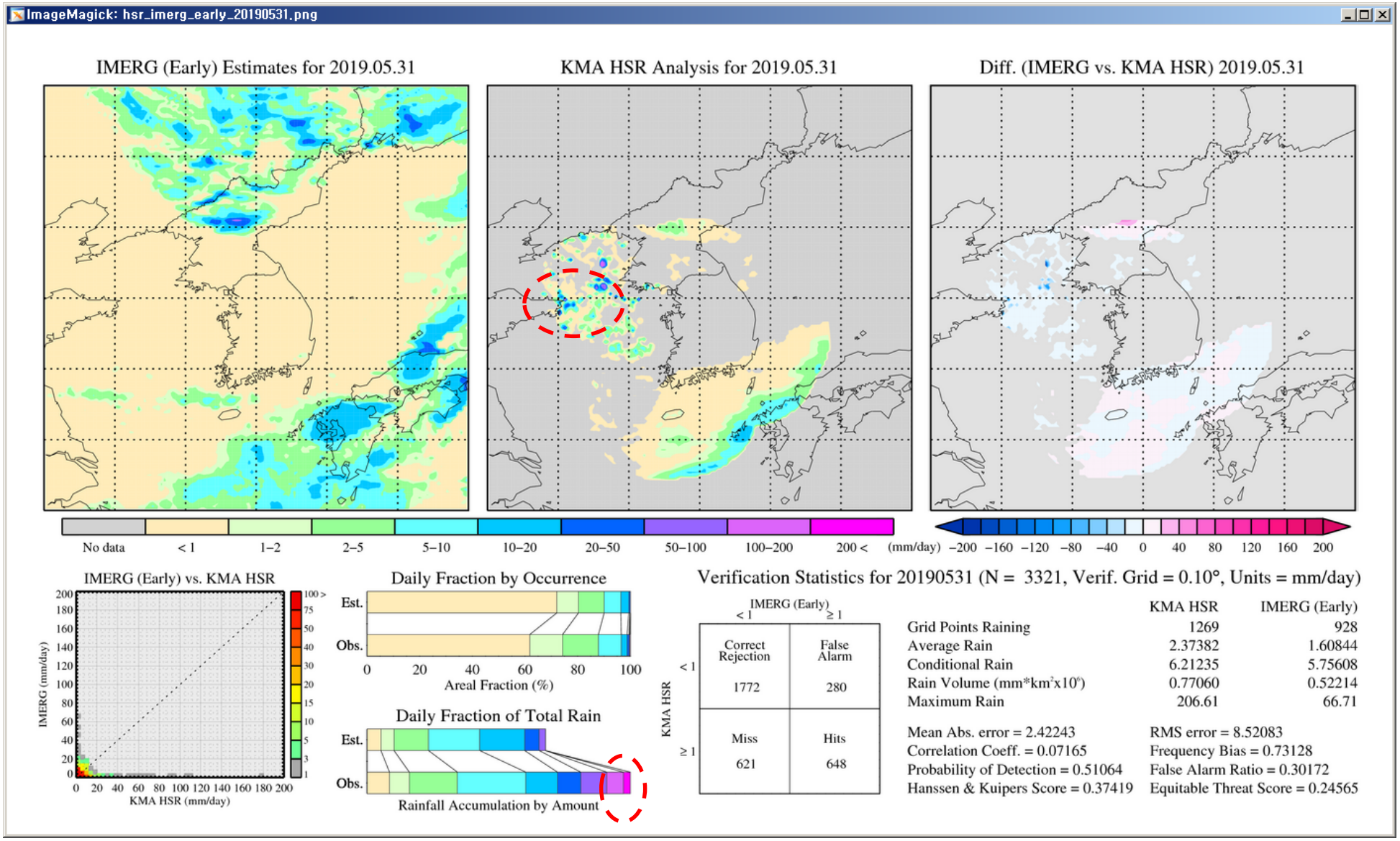


The application of radar data based on single elevation (angle) has limit in QPE and a proper technique to overcome the effects due to mountainous terrain is necessary for improving the accuracy in radar QPE as well as good quality control process.

Ground Validation with RAR



Ground Validation with HSR



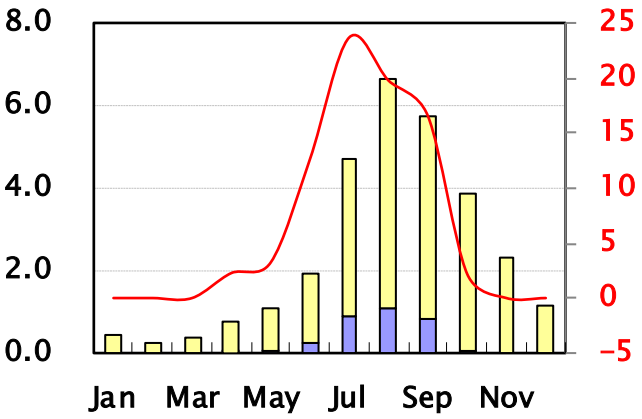
Summer 2019

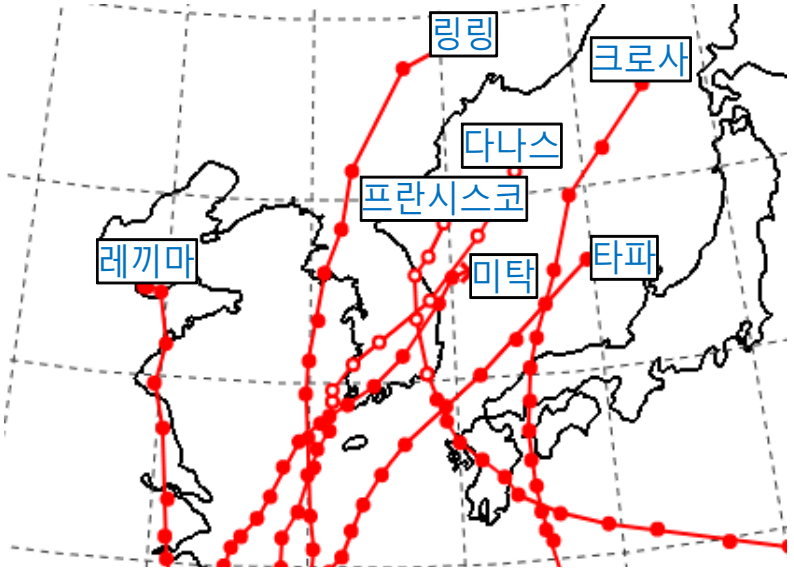
- Monthly mean rainfall is 712mm which less than over recent 30 years (1981-2010)

	Total	Jun	Jul	Aug	Sep
30-yr Avg	886.0	158.6	289.7	274.9	162.8
2019(mm)	712.0	143.1	216.6	140.7	221.2
ratio	80.8%	87.4%	74.8%	52.4%	136.3%

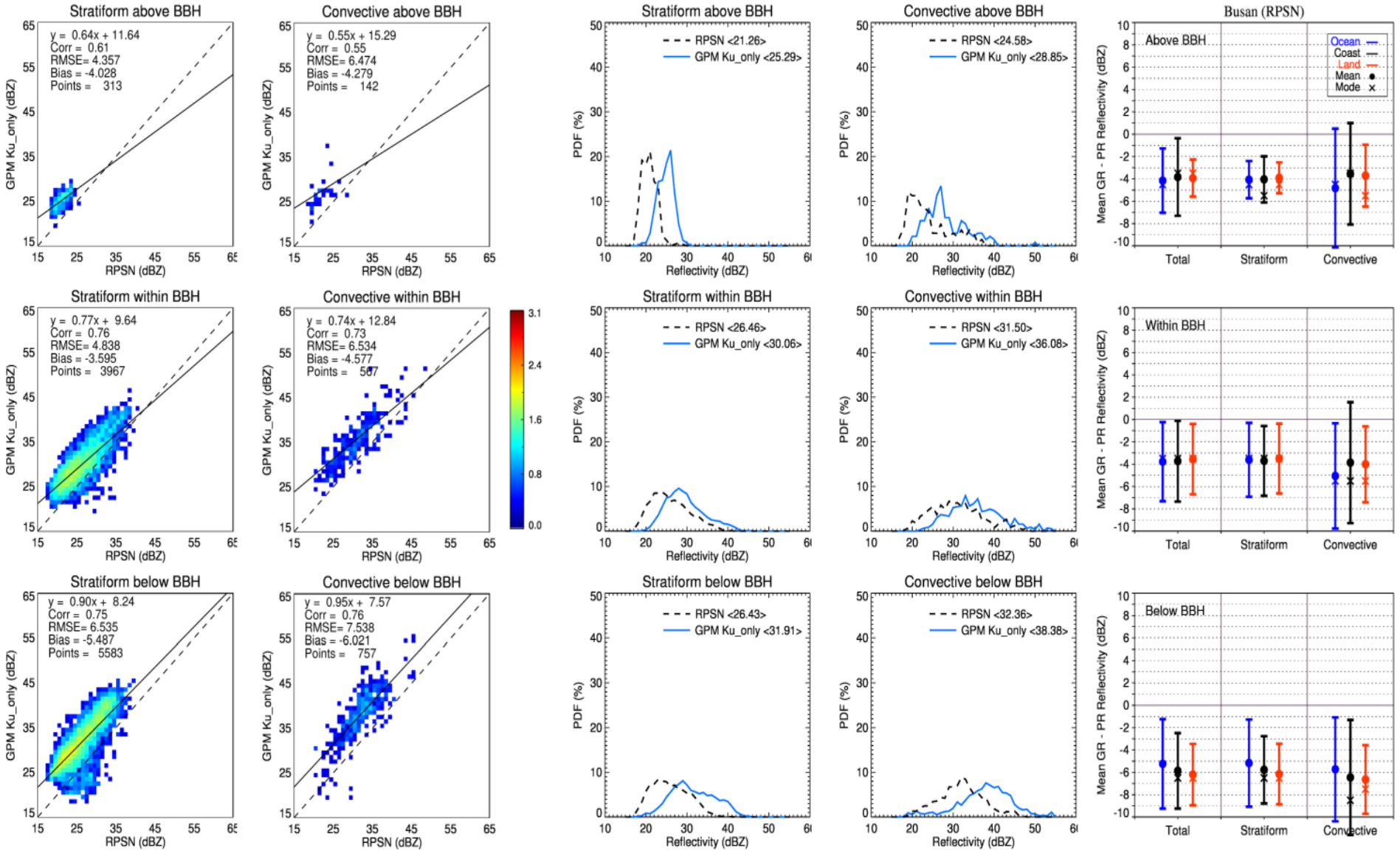
- Typhoon activity
  - Annual mean occurrence is 11 (direct impact 2)
  - 7 out of 24 typhoon occurred are impact to Korea this year

<Typhoon occurrence rate by month>



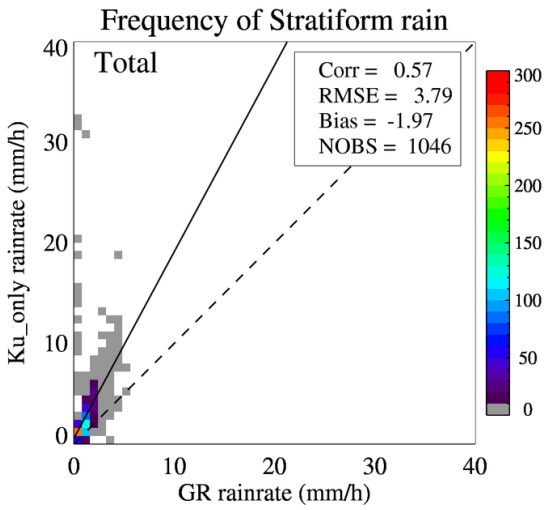


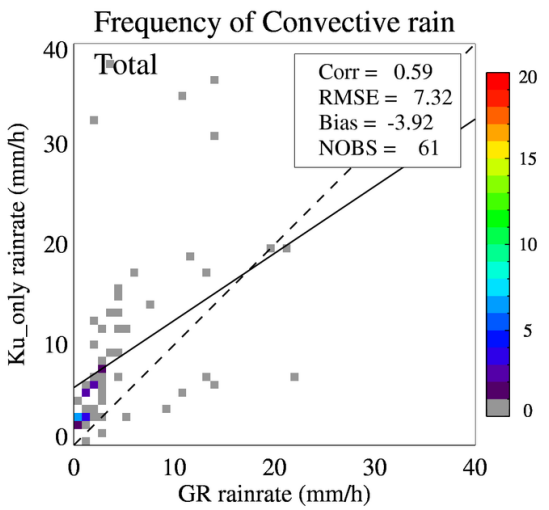
GPM Ground Validation (2018.3. ~ 2019. 2)



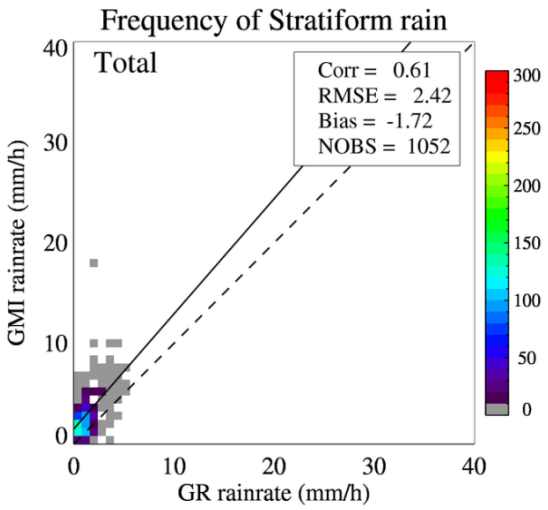
Rain rate scatter plot by cloud type

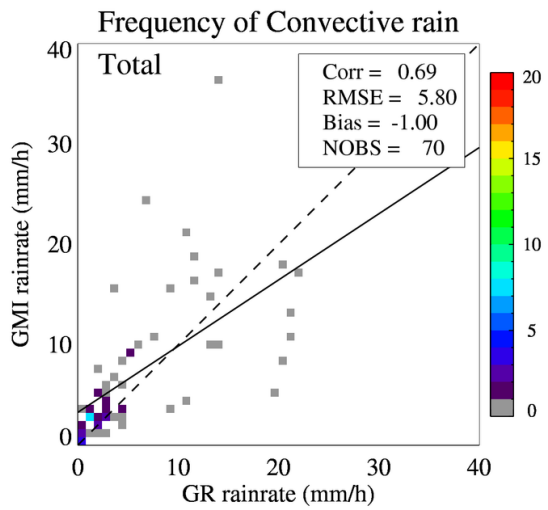
GR vs GPM Ku



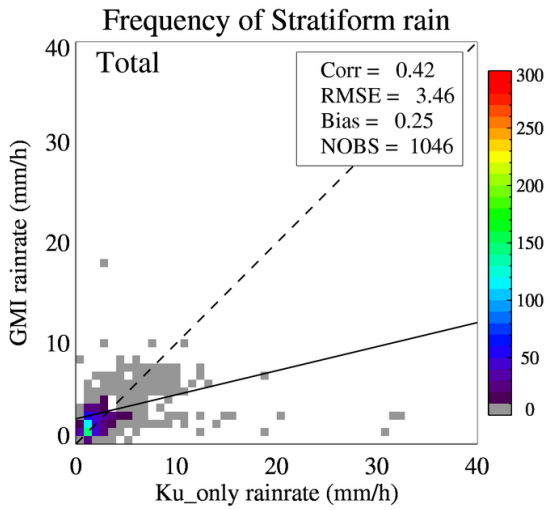


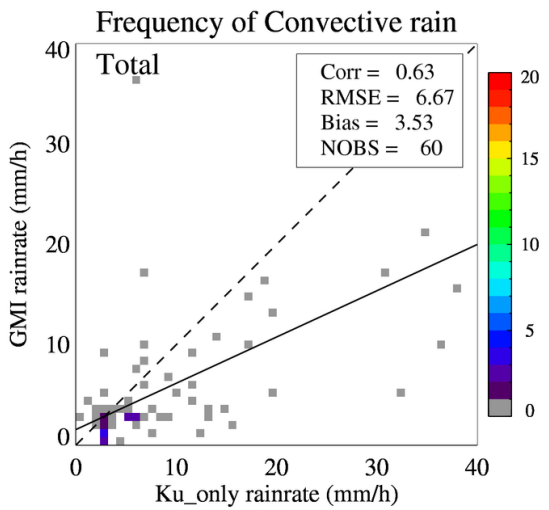
GR vs GPM GMI





GPM Ku vs GMI



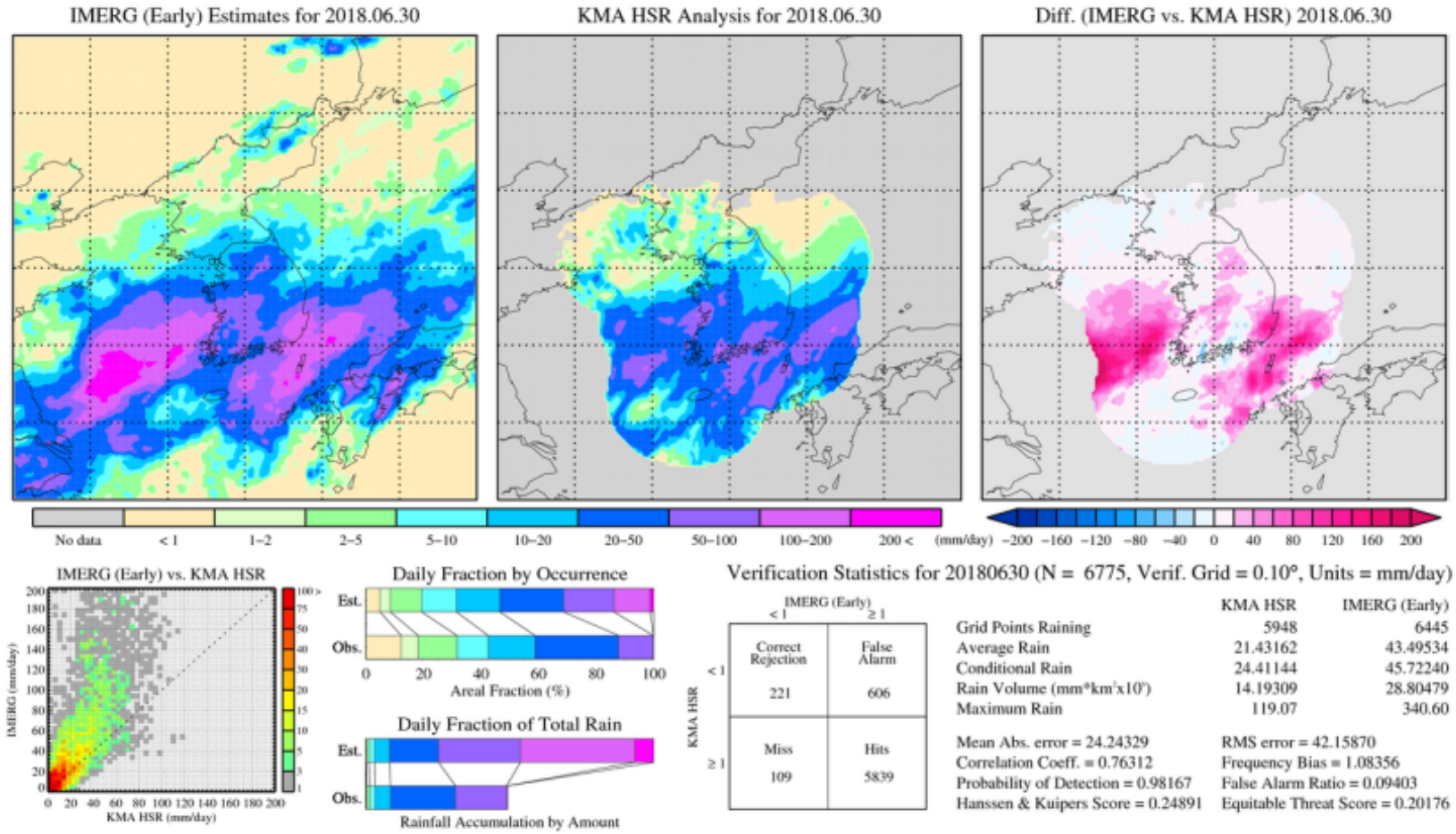


Stratiform

Convective

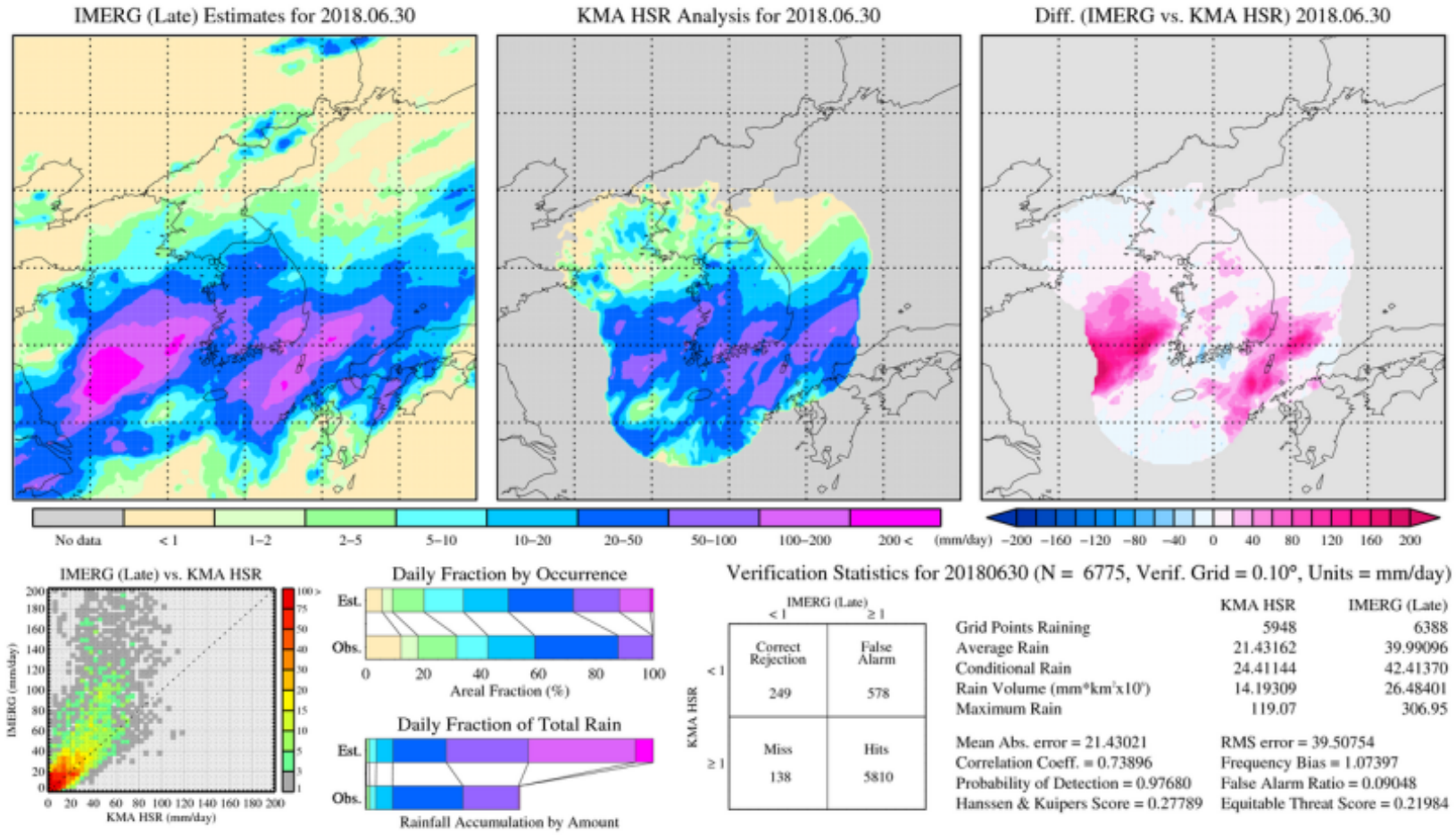
Example validation

IMERG Early

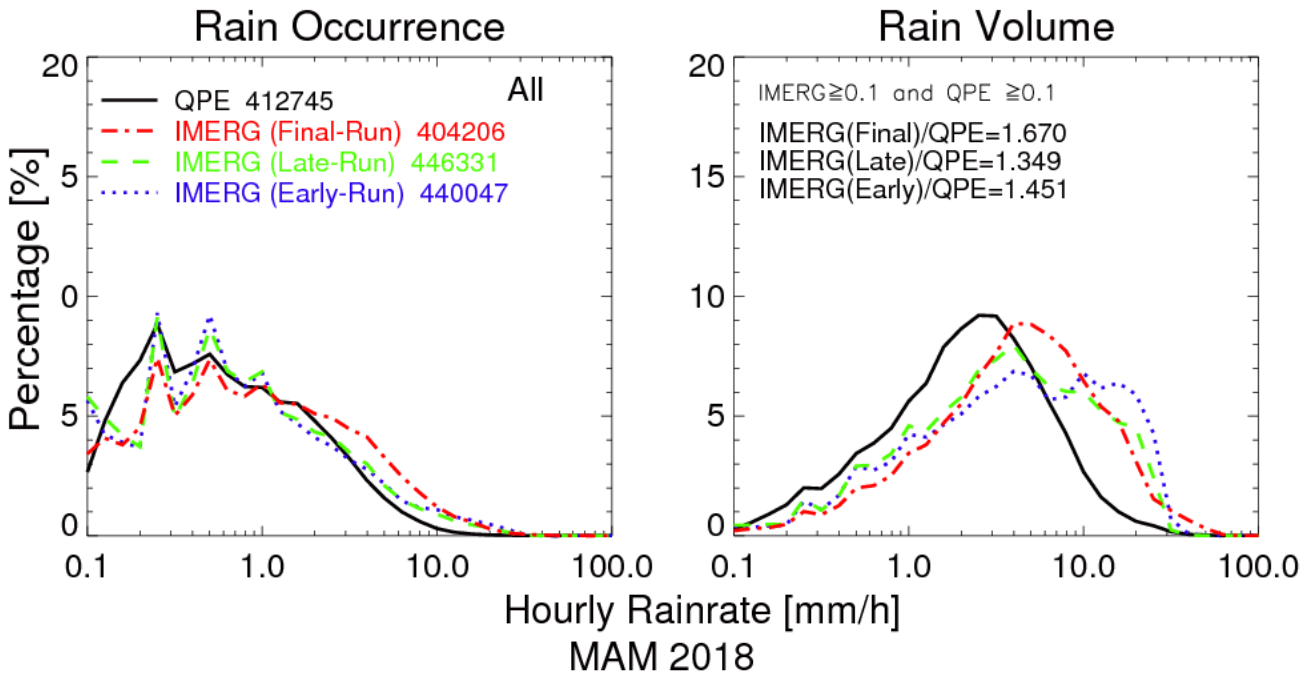


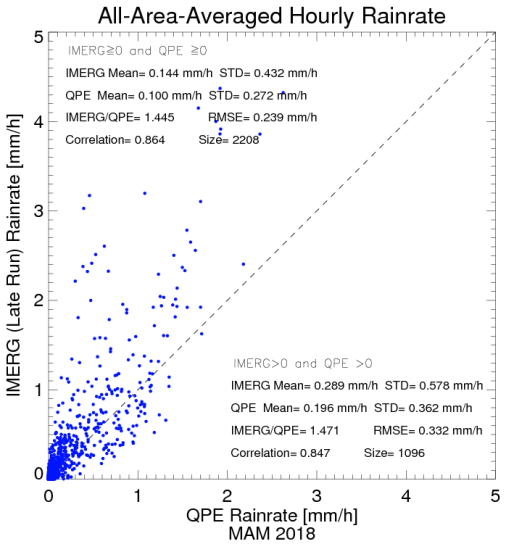
Example validation – cont.

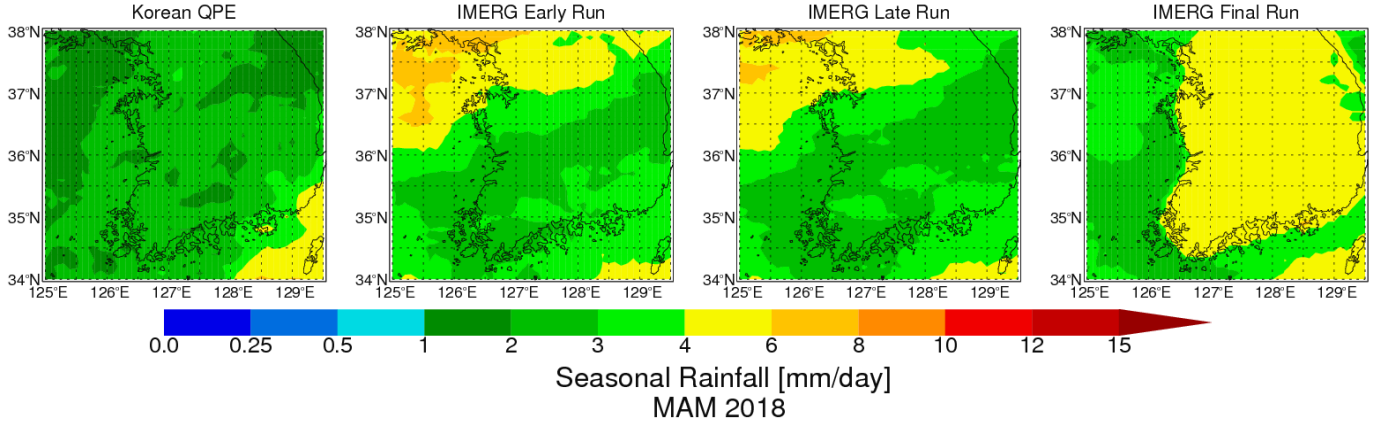
IMERG Late

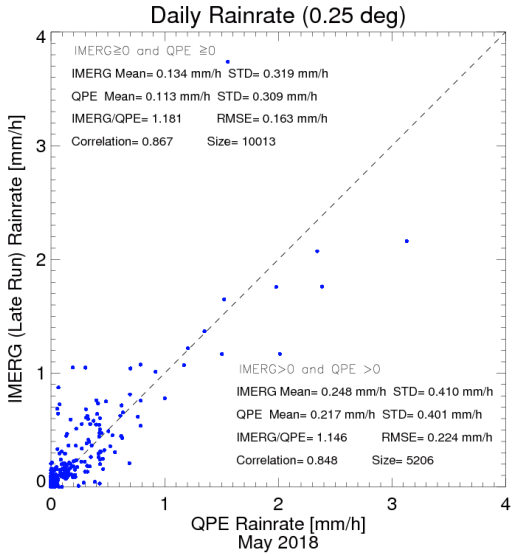


GPM IMERG(V05) vs Korean QPE









Courtesy of GSFC

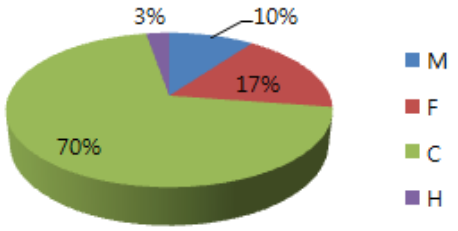
ICE-POP 2018

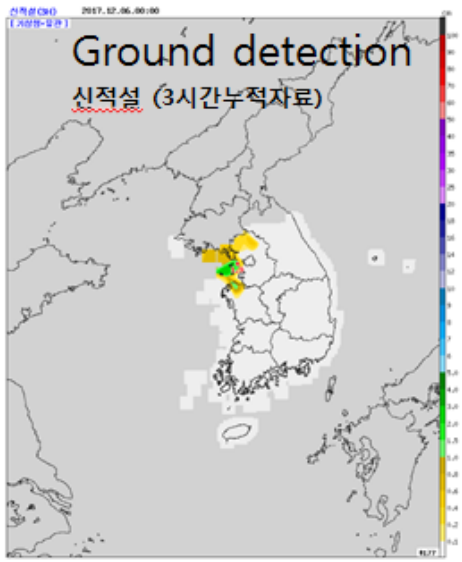
- Snowfall rate retrieval
- Ocean flux

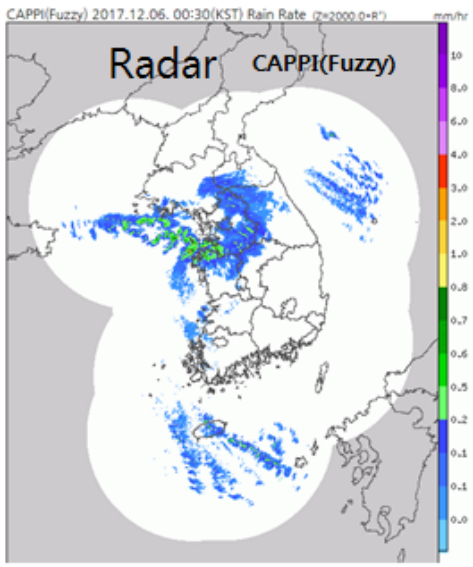
국가기상위성센터
National Meteorological Satellite Center

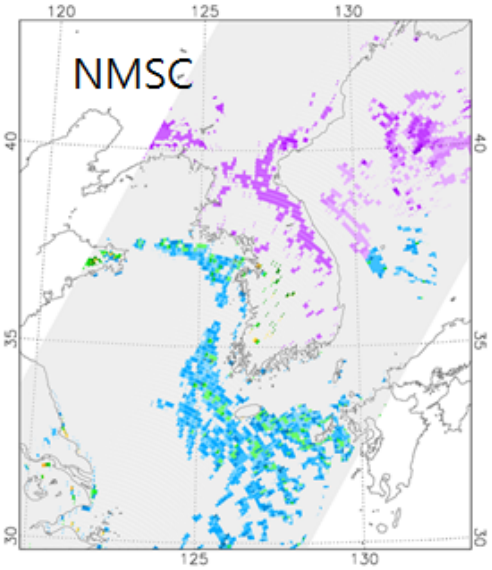
1. Snowfall rate validation

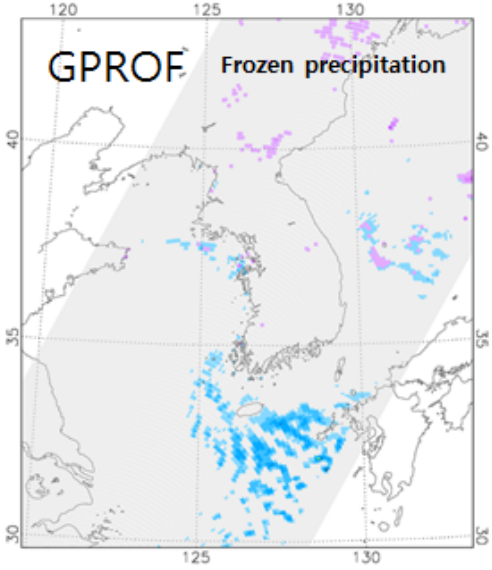
		NMSC	
		Yes	No
GPROF	Yes	Hits (H)	Misses (M)
	no	False alarms (F)	Correct negatives (C)

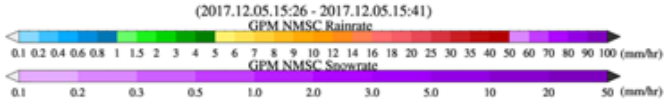


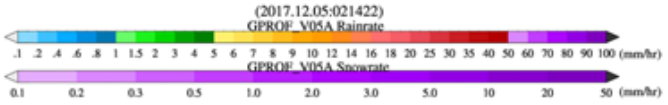












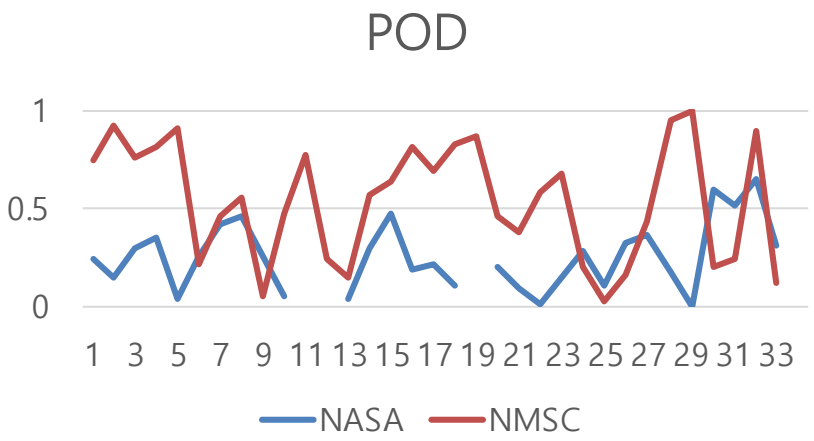
Comparisons with GPROF

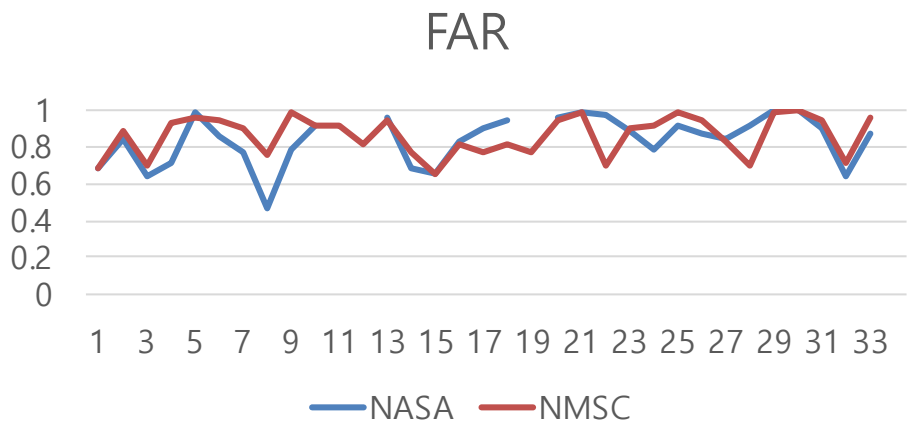
※ compare ground radar with GPROF(NASA) and KMA(NMSC)

- Period: ‘17.12. ~ ‘18.2.

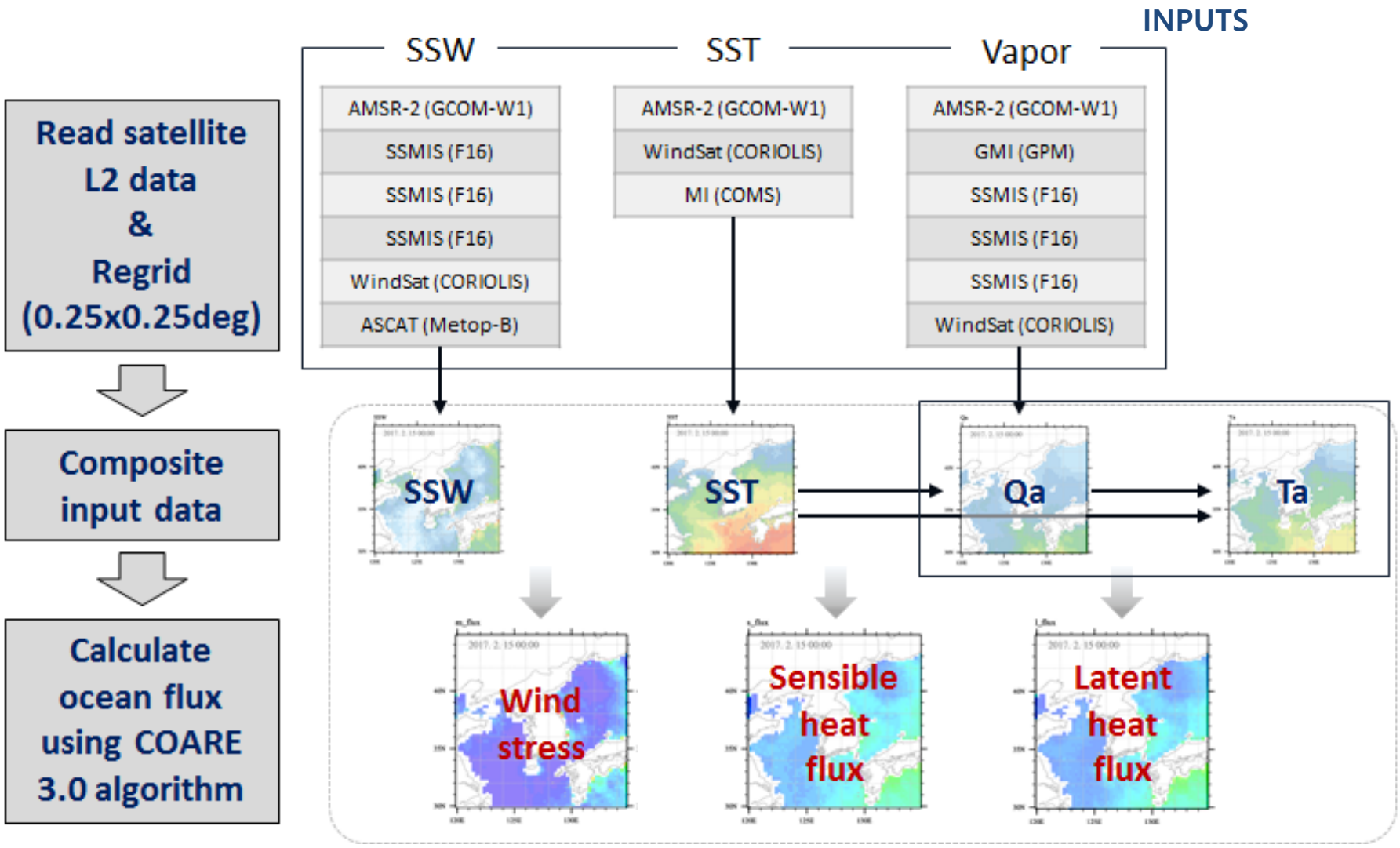
	POD	FAR	TS
NMSC	0.57	0.83	0.14
NASA	0.29	0.81	0.12

		NMSC (or NASA) around 33 cases	
		Yes	No
RAR	Yes	26,591(14,819) Hits	20,271(35,185) Misses
	no	139,241(64,061) False alarms	203,524(290,077) Correct negatives

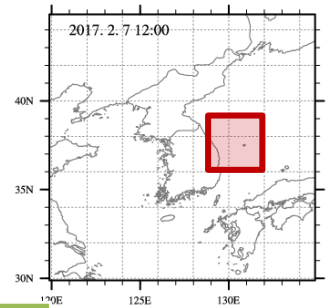




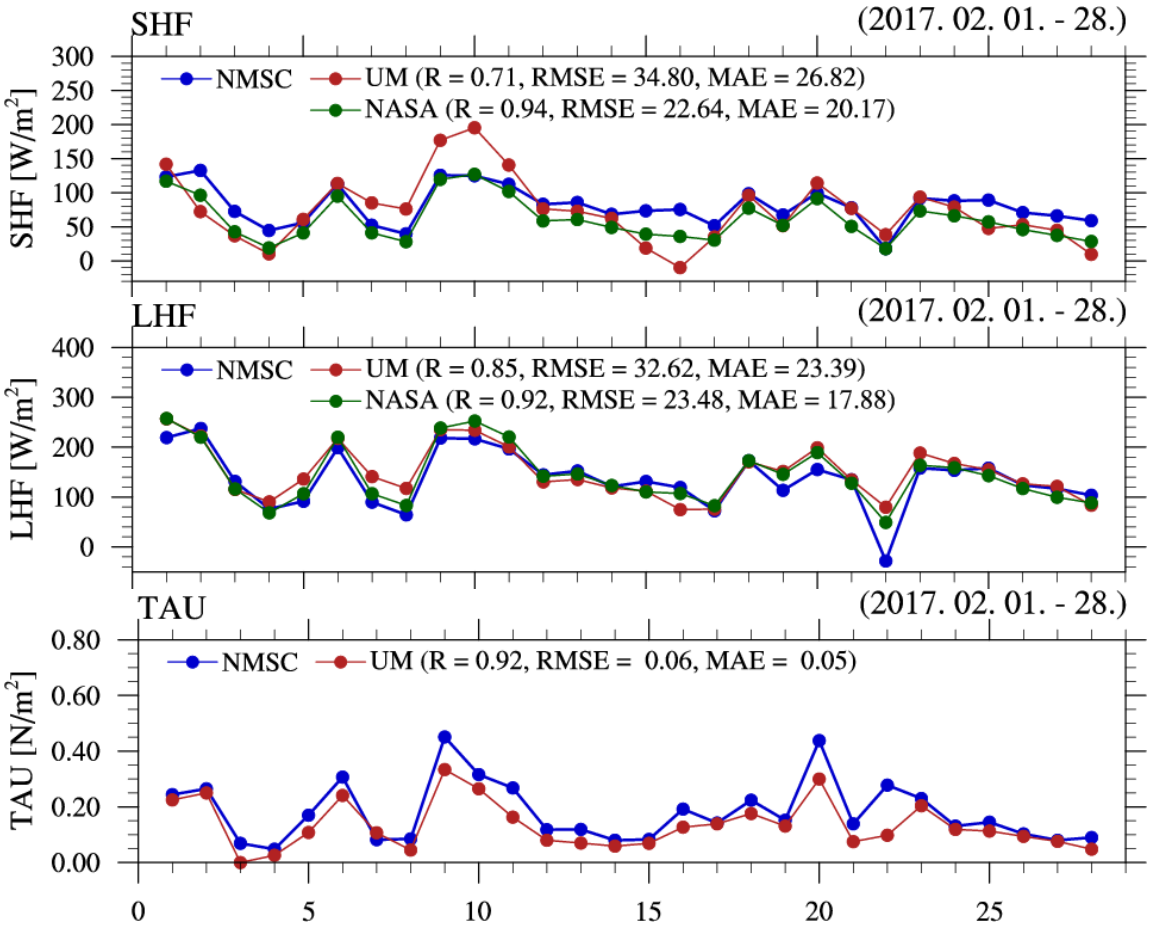
2. Ocean surface heat flux based on space-borne sensors over Korea



Comparisons



✓ UM vs. NASA vs. KMA – February 2018

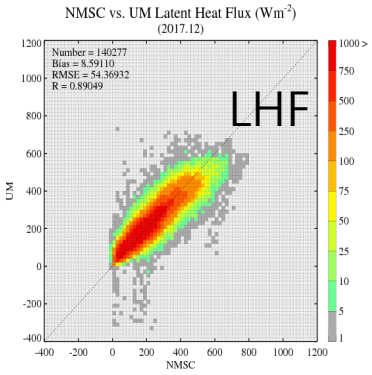
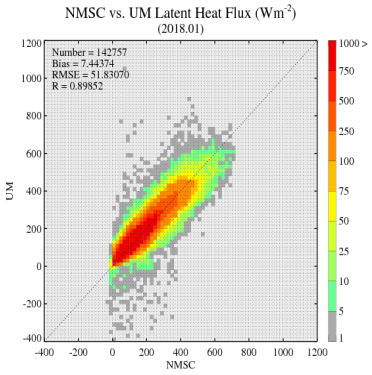
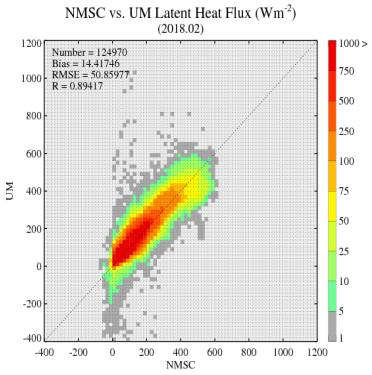
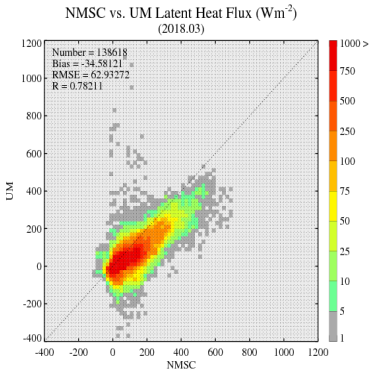
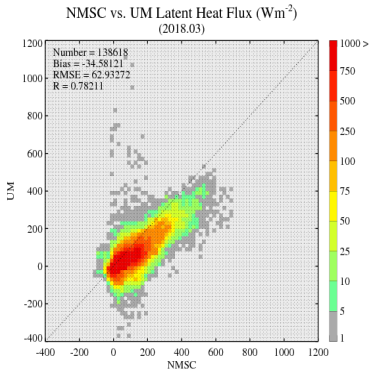
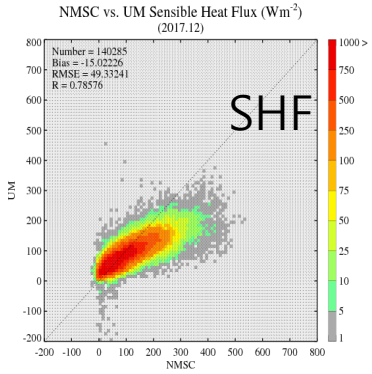
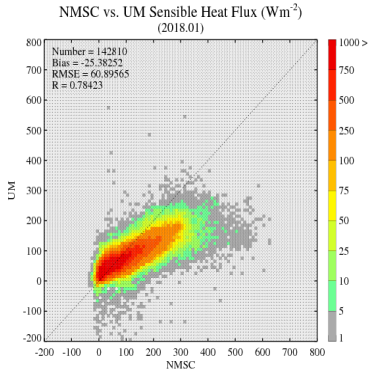
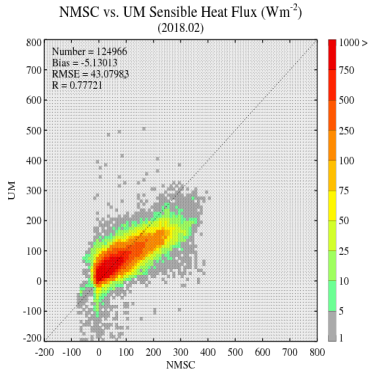
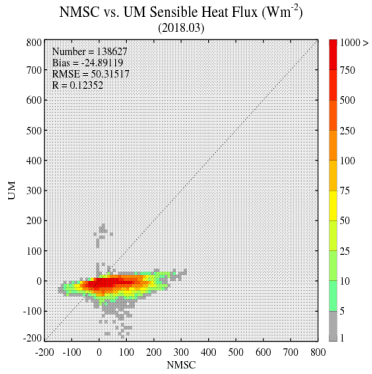
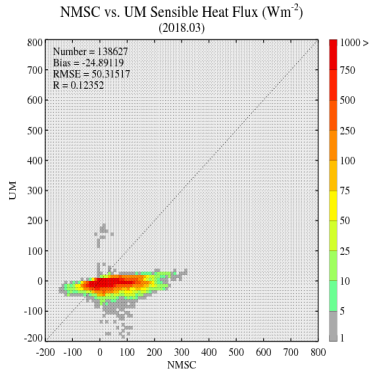


SHF	UM	NASA
R	**0.71**	**0.94**
RMSE	**34.80**	**22.64**
MAE	**26.82**	**20.17**

LHF	UM	NASA
R	**0.85**	**0.92**
RMSE	**32.62**	**23.48**
MAE	**23.39**	**17.88**

TAU	UM
R	**0.92**
RMSE	**0.06**
MAE	**0.05**

KMA vs. UM

2017.12	2018.01	2018.02	2018.03	2018.04
				
				

Thank you!

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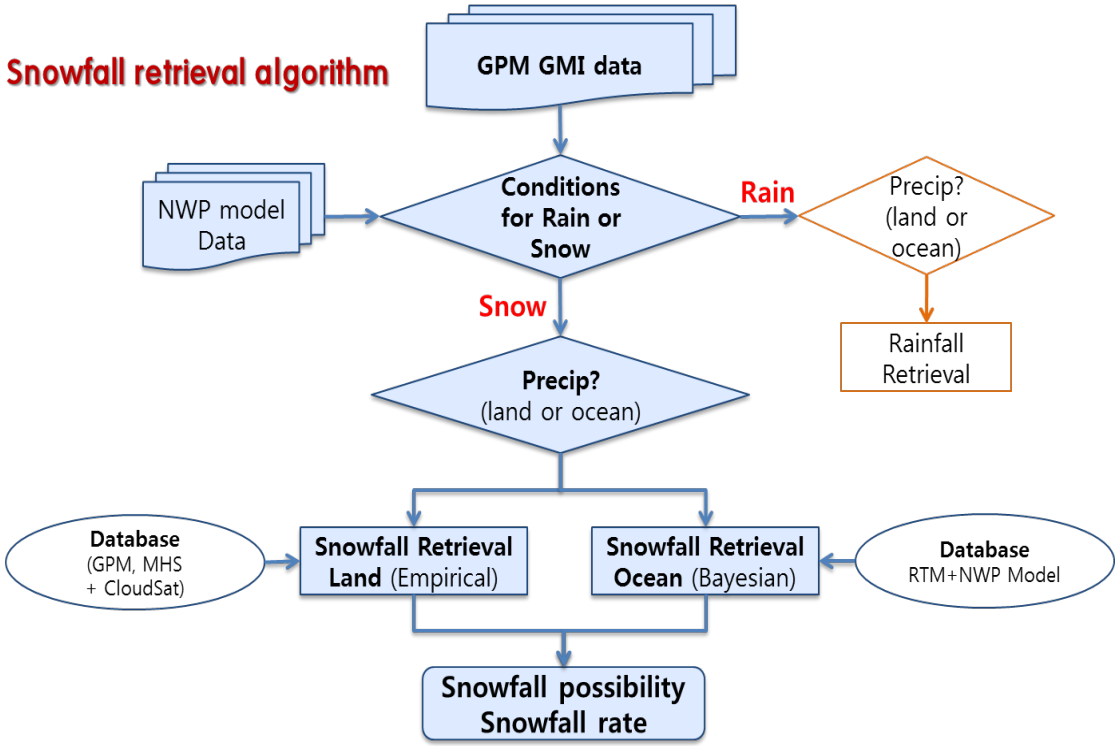
NMSC

Backup Slides

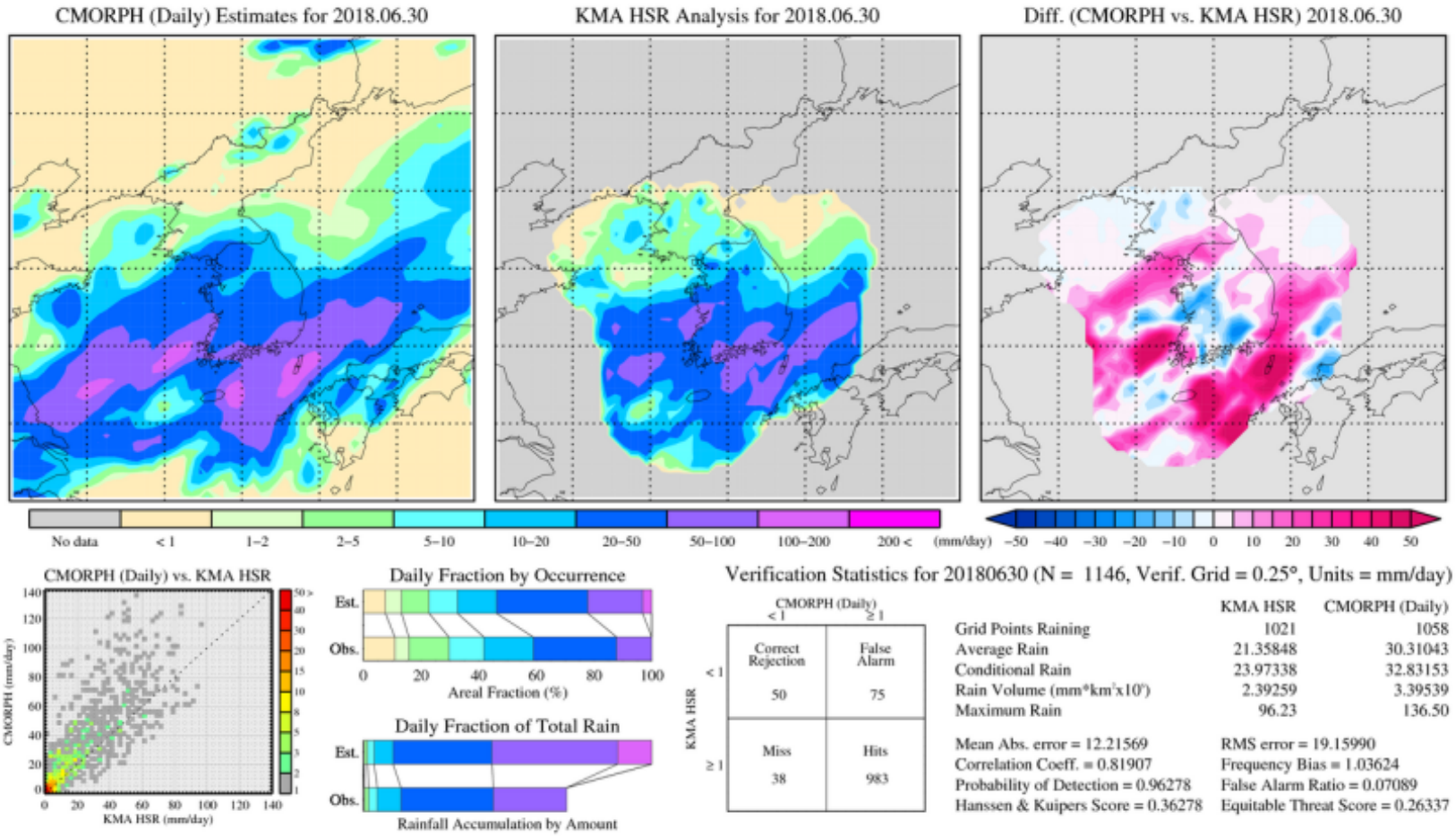
Snowfall rate retrieval based on microwave satellite over Korea



- GMI를 훈련하기 위해 CloudSat CPR+GPM DPR 사용하여 EOF 공간에서 DB 구축
- DB를 다양한 지면과 대기 환경에 따라 구축 (ocean, land, sea ice, snowcover, and TPW)
- 산출물은 강설확율과 강설강도

Example validation images – cont.

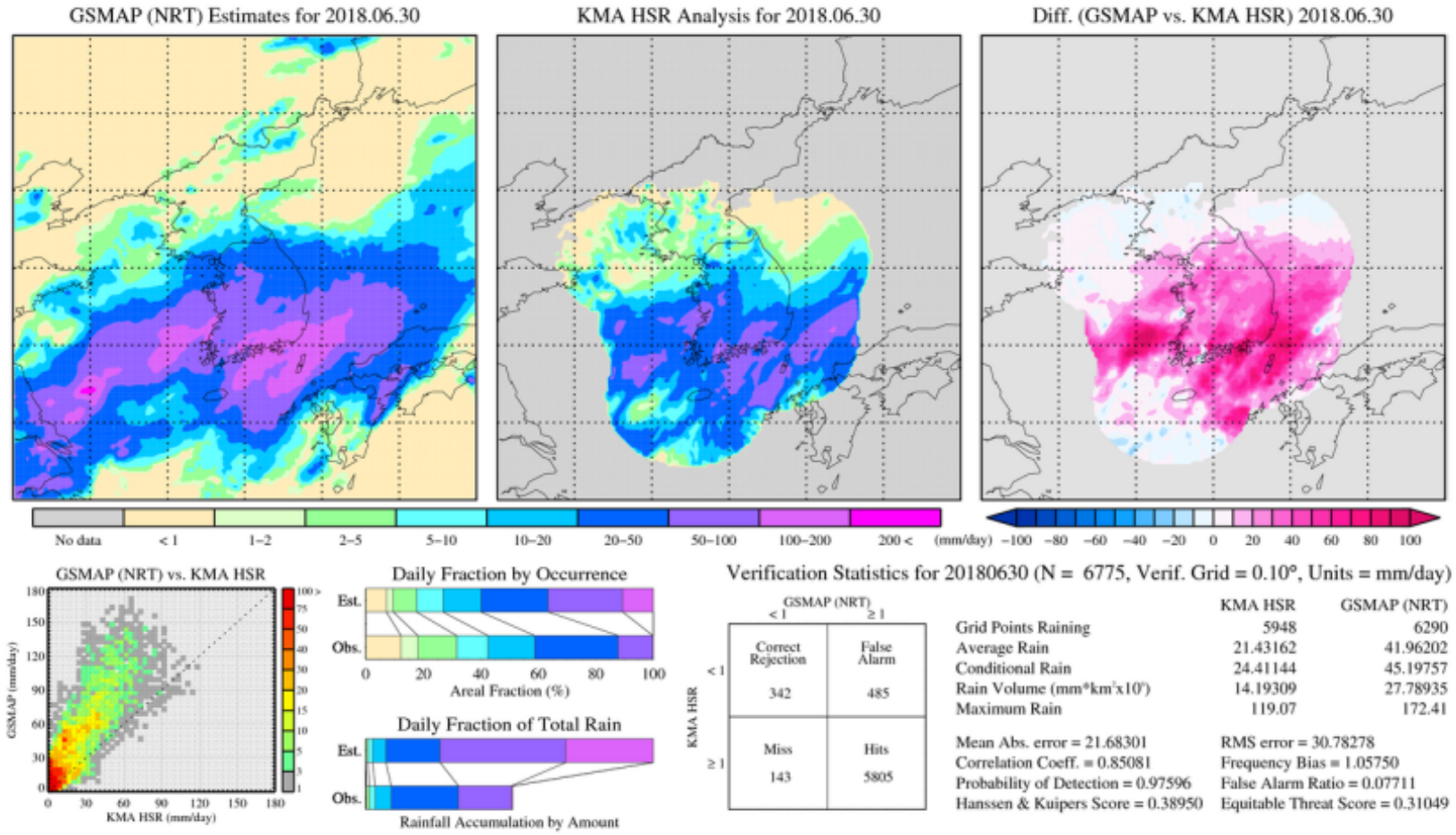
CMORPH



Example validation images

IPWG validation/intercomparison

GSMaP NRT



Example validation images – cont.

GSMaP NOW